

ASTRONOMICAL LANTERN SLIDES

Mark Butterworth



Fig. 1 The Mary Dicas slide set, manufactured c.1785 (Lester Smith Collection).

THE ASSOCIATION OF THE MAGIC LANTERN and astronomy goes back to the earliest days of the lantern. The development of optics in the sixteenth and seventeenth centuries had the same dramatic impact on astronomy as it did on projection. Christian Huygens (1629–95), widely credited with the invention of the lantern, is also a well-known figure in the optical development of the telescope and eyepieces. Even today, a Huygens lens is one of the most popular configurations of telescope eyepiece optics. Astronomical slides produced from Huygens to the beginning of the nineteenth century were hand-crafted, hand-painted and constructed individually or in very small quantities.

SOME ASTRONOMICAL SLIDE MAKERS

From 1776 onwards Adam Walker (1731–1821), or his sons William and Deane, toured the UK and occasionally Europe, lecturing on astronomy with the ‘Grand Transparent Orrery’ also known as the Eidouranion (from Greek – ‘form of the heavens’). Details of Walker’s equipment are sparse, but one illustration exists, showing a display apparently using some form of back-projection.¹ A Mr Greene offered the same Eidouranion lecture at Mr Stelle’s Hotel in the city of Washington in 1801, claiming he was a former student of Walker.

Mary Dicas, a mathematical instrument maker of Pool Lane, Liverpool, manufactured a ‘Portable Eidouranion or Astronomical Lucernal’ (Fig. 1).² John Clegg described this system around 1795:

the apparatus consists of a magic lantern, lighted by a patent lamp; a number of slides, upon each of which is delineated three schemes, representing either a single astronomical object, or a figure illustrative of some celestial phenomenon; together with a

number of circular Cells, which are fitted to, and are successively to be fixed in, the flat Box, which contains a correspondent set of machinery for setting in motion their constituent parts, by means of a small whince or handle, which is adapted thereto.³

This description was followed by a list of eight slides and nine movements (mechanical rackwork slides), and included a lecture to accompany the slides.

The Dicas set included one slide with black paper discs showing either the sun or earth at the centre and hundreds of pinpricks marking the path of each planet, the paper being protected by cover glasses. The Werner Nekes collection includes several mahogany frames dated c.1800 consisting of multiple openings covered with paper, with star-shaped cut-outs of the major stars from some of the better-known Northern constellations.⁴ The sizes of the cut-outs relate to the brightness of each star.

Around 1795, Dr Thomas Garrett was lecturing in Liverpool. Using the Lucernal he offered,

the planets will seem suspended in space without any support, performing their annual and diurnal revolutions, without any apparent cause.⁵

In 1799, Adam Walker mentioned that the magic lantern would be suitable to demonstrate astronomical movements.⁶ The book of his lecture also describes several astronomical phenomena he illustrated with the Eidouranion, each resembling the earliest effects seen in rackwork astronomical slides. In 1824, a Mr Rogers was lecturing in Bath, using a ‘New Transparent Orrery’ supplementing its images with sets of transparencies of the sun, moon, planets and nebula painted by a Mr D’Arcy ‘from original drawings by Dr Herschel’ (the eminent astronomer Sir Frederick William Herschel, 1738–1822). He was also offering views with ‘a newly invented grand transparent Microscope’.⁷

In 1825, John Wallis delivered popular lectures on astronomy at the Assembly Rooms, Cateaton Street, London, illustrated by ‘an original apparatus devised and constructed by his own hands ... including an extensive mechanism and numerous brilliant transparencies’.⁸ Between 1827 and 1845 he delivered ‘astronomical discourses elucidated by transparent and moving paintings’ at the London Institution, Finsbury Circus.⁹ Throughout the 1830s many lecturers were advertising similar ‘transparent paintings or transparent moving scenery’ on their handbills. John Ramage of Aberdeen also mentioned showing ‘fifty splendid transparencies’.¹⁰

CARPENTER & WESTLEY AND OTHERS

Also in 1825, a lecturer named R. Ebsworth was offering a set of astronomical magic

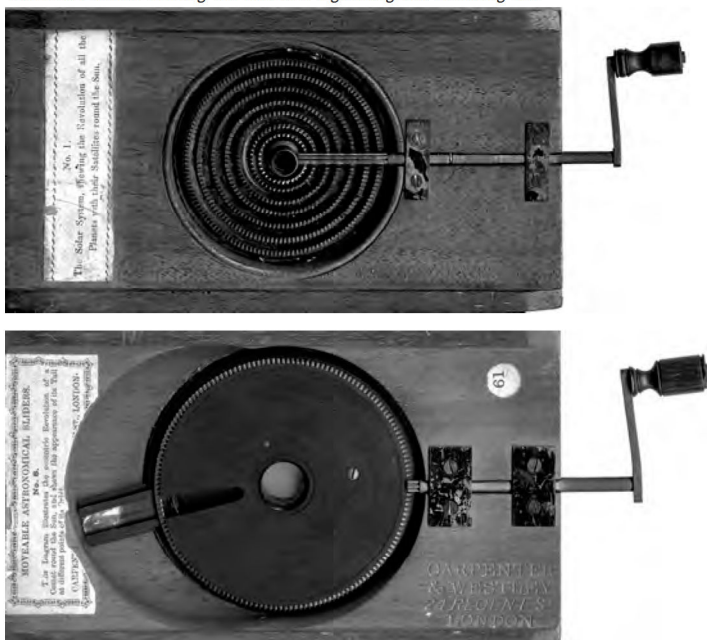
NOTES

1. The illustration is reproduced in Wendy Bird, ‘Enlightenment and Entertainment: the Magic Lantern in Late 18th- and Early 19th-Century Madrid’, in Richard Crangle, Mervyn Heard and Ine van Dooren (eds), *Realms of Light: Uses and Perceptions of the Magic Lantern from the 17th to the 21st Century* (London: Magic Lantern Society, 2005), 91.
2. Mary and her sister Ann inherited the business from their father John Dicas. It ceased trading around 1837.
3. John Clegg, *A Concise description of Dicas’ portable Eidouranion or astronomical lucernal; with particular directions for applying the apparatus belonging to it; and a summary dissertation on the various phenomena which it is designed to exhibit and illustrate* (Liverpool: published by the author, n.d.). The date of c.1795 is ascribed by the UK Patent Office. See Herman Hecht, *Pre-Cinema History: An Encyclopaedia and Annotated Bibliography of the Moving Image Before 1896* (London: Bowker Saur, 1993), item 103C.
4. See Bodo von Dewitz and Werner Nekes (eds), *Ich Sehe Was, Was Du Nicht Siehst! Sehmaschinen und Bilderwelten* (Göttingen: Steidl, 2002), 162.
5. *Gore’s Liverpool Advertiser*, 23 July 1795.
6. William Walker, *An Epitome of Astronomy including an account of the Eidouranion or Transparent Orrery* (Bungay, Suffolk: William Walker, 1802).
7. Museum of the History of Science, Oxford, document 72-12:160D.
8. William Hone, *The Every-Day Book* (London: 1826), 30. Hone also wrote ‘Here is a sure mode of acquiring astronomical knowledge, accompanied by the delightful gratification of witnessing a display of the heavens more bewitching than the mind can conceive’.
9. *Proceedings of The Royal Institution of Great Britain 1835*, 33.
10. Poster in Aberdeen Public Libraries Poster Collection.



Fig. 2 A Compendium of Astronomy: Philip Carpenter's copper plate sliders, c. 1825, complete with original reading booklet.

Fig. 3 Mechanical slides showing movement of planets around the sun and a comet orbiting the sun with a growing and shrinking tail.



lantern slides together with a collection of lecture notes. In the Introduction to his lecture, Ebsworth complained about current lantern practice, regretting
*that so ingenious an Optical Instrument as the Magic Lantern should be almost exclusively devoted to the exhibition of subjects that are extremely trifling, and in some instances absolutely nonsensical. To obviate this evil I have prepared a new series of Astronomical Diagrams, with Telescopic views of the planets, displaying the various phenomena of the science in a manner at once pleasing and demonstrative.*¹¹

One of the major developments in lantern history, of course, was the introduction of 'copper plate slider' mass-produced slides by Philip Carpenter of London. His first set of slides, offered around 1823, was of zoological subjects. But by sometime in the mid-1820s he was also offering a set of astronomical slides (Fig. 2). Consisting of eight strip slides (each with three or four images), one slipping slide showing eclipses of the sun, and a lever slide to demonstrate the rotundity of the earth, the set covered all the basic principles demonstrated by the popular lecturers discussed above. The complete set was entitled *A Compendium of Astronomy* and the accompanying reading describes the set as 'A Series of Diagrams exhibited by the improved Phantasmagoria Lantern'. Although of good quality, the images do not show the superb detail and artistic handwork that later distinguished Carpenter & Westley slides.

Carpenter's astronomical slides match the sequence of Ebsworth's lecture. It is possible that they developed the same sequence independently, but more likely that Ebsworth used Carpenter's slides, perhaps providing the initial incentive for Carpenter to produce the set commercially. This slide set marks the beginning of commercial volume production of astronomical slides.

Many other makers produced astronomical slides before 1850. Unfortunately most failed to mark their slides and so remain unidentified. Examples exist in many formats: long glass pieces with multiple painted images on a black background, solid mahogany frames with one, two, three or four circular openings; all types exist in various sizes. By about 1840, Carpenter & Westley were producing mahogany framed slides in the familiar 4 x 7 inch format, and by 1849 they were offering the *Compendium of Astronomy* set in that format, consisting of thirty-two slides. They were also advertising their sets of rackwork 'Astronomical Diagrams' in a set of ten, with at least three additional rackwork slides available, and with further sets on Chinese and Arabic Astronomy on offer. In his *London Labour and the London Poor* of 1861, Henry Mayhew described the experiences of a street microscope demonstrator (probably recorded around 1830), who gave him the story of the astronomy lecturer Mr Robert Children:

*then he got a magic-lantern with astronomical slides. The bull's-eye was six inches in diameter, so they were very large, so that they gave a figure of twelve feet. For the signs of the zodiac he had twelve separate small lanterns, with the large one in the centre to show the diverging rays of the sun's light.*¹²

It is tempting to assume that the wide range of slide sets available from multiple manufacturers all stem from a common 'storyline', since they all use somewhat similar images. However, studying astronomy books from the same period could lead to the same conclusion. Both reflect the widely accepted state of knowledge at the time and the generally regarded appropriate sequence to instruct non-professionals in the subject. Many of the illustrations are remarkably similar to those found in books today and still convey the subject in a clear and understandable manner. The images and sequencing are generic.

During the 1850s astronomical slides began to be available from Newton & Co. They followed a very similar lecture format to the Carpenter & Westley slides, as did their standard set of ten rackwork slides. Whether Carpenter & Westley or Newton & Co. were the first to produce the standard rackwork set is not known, although obviously Mary Dica's was offering slides of a similar type many years earlier. Each rackwork slide (whether from Newton or Carpenter & Westley) shows a degree of ingenuity in its workings, and one slide showing the movement of all the planets in the solar system and another showing the orbit of a comet around the sun are particularly complex (Fig. 3). The mechanisms devised to explain the

movements of planets and other phenomena translated into subtle mechanical devices, and rackwork astronomical slides frequently show some of the most intricate effects of any mechanical slides.

BOOKS AND OTHER PUBLICATIONS

It was common for slide sets to accompany a recently published book. Not only did this encourage sales of both, but also the economics of producing illustrations for a book and slides were more attractive. Although Newton & Co. were first recorded as trading in 1852, a book on astronomy and globes written by W. Newton in 1844

11. A popular treatise on astronomy intended to accompany a new series of astronomical diagrams as made, and sold, by R Ebsworth, optician; to be conspicuously exhibited by the magic lantern, in the form of a familiar lecture, both pleasing and instructive, on that sublime science (London: 1825).

12. Henry Mayhew, *London Labour and The London Poor: A Cyclopaedia of the Conditions and Earnings of Those that Will Work, Those that Cannot Work and Those that Will Not Work* (London: 1861), Vol. III, 84.

states in its Introduction that it is derived from a series of lectures and can be used as an accompaniment to 'a set of Astronomical Diagrams, to be exhibited in the magic lantern'.¹³ Edwin Dunkin, an employee at the Royal Observatory in Greenwich, produced a popular guide to astronomy entitled *The Midnight Sky* and York & Son of London eventually offered slides to accompany the book.¹⁴

James Nasmyth (1808–90, inventor of the steam hammer) devoted his later life to observing the moon, and in 1874 produced a classic work on that celestial body.¹⁵ It was illustrated with nineteen Woodburytype prints, each individually pasted into the book, and slides of the same images were available in both the UK and US formats (Fig. 4). Newton & Co. produced a set of photographic slides from his images, while York & Son also used some of the prints in their slide sets.

Many individual slides were produced by the major manufacturers, to be added to pre-arranged lecture sets. Carpenter & Westley produced mechanical slides showing the rotation of the major constellations around the north and south celestial poles. Slides were produced showing the major satellites of Jupiter orbiting the planet. Several types of mechanical slides were developed to show the sudden appearance of the corona during a total solar eclipse, including complex mechanisms with diaphragms to allow the sun's atmosphere (corona) to appear instantaneously. I have seen a mechanical slide designed to show shooting stars, using a dark rotating disk with a single bright flash.¹⁶ A slide of stars in the sky would be shown on screen with this slide superimposed – a rare example of an astronomy slide for use with a biunial lantern. There were also mechanical slides of aurorae, showing shimmering light effects. Other slides showed atmospheric effects such as mock suns ('sundogs') and the effect of looming – the appearance above the horizon of a distant object that would normally be hidden below it, caused by unusually large terrestrial refraction due to a thermal inversion. Several slides of nebulae and galaxies were available, nearly all based on drawings from Lord Rosse's telescope at Birr in Ireland.

In the early 1920s, London publisher Hutchinson produced a series of magazines under the title *The Splendour of the Heavens*, edited by the Reverend T.E.R. Phillips.¹⁷ At the same time, Phillips was producing readings to accompany Newton's astronomy slides; a special series of twenty-four slides based on *The Splendour of the Heavens* was available showing the night sky over the London skyline, with two slides for each month of the year, looking north and south.

THE TRANSIT OF VENUS

Communicating astronomical concepts continually gave manufacturers opportunity to develop complex and intricate slide designs. One example is a brass and glass slide measuring 4 inches by 7 inches (10 x 17.5cm), shown in Fig. 5. It shows the 'black drop effect' observed during a Transit of Venus, when the planet passes across the face of the sun. Transits of Venus are rare astronomical events and occurred only twice during the nineteenth century, in 1874 and 1882 (there were none in the twentieth century, one in 2004 and the next is expected on 6 June 2012). As the trailing edge of the planet moves away from the edge of the sun at the start of the transit, or the leading edge moves against the edge of the sun at the end, its circular outline appears to 'bleed' into the edge of the sun.

The slide has a complex winding mechanism that pulls a glass disk diagonally across the body of the slide. On the moving disk is a small dark spot to represent Venus. There is a fixed orange glass disk representing the sun. As the ivory handle is turned, Venus's disk appears at the edge of the slide and moves onto the solar disk. Then as the trailing edge of Venus reaches the edge of the sun, the 'black drop effect' appears, with Venus apparently 'bleeding' into the edge of the sun. Then, suddenly, the planet appears to 'jump' away from the edge and appears as a circular disk again.

The transit of Venus in 1874 was widely publicised and the slide probably dates to just before that time. Astronomers worldwide prepared to observe the event and many observatories developed elaborate devices to train observers on how to time the event and what to expect when seeing the black drop. It is not clear if this slide was to educate public audiences or to train astronomers.

SLIDE DEVELOPMENTS

Many of the hand-painted slides from the middle of the nineteenth century are beautiful works of art (Fig. 6). Most astronomical texts of the time featured only



Fig. 4 Woodbury slides for the UK and US markets produced from Nasmyth's book *The Moon*.

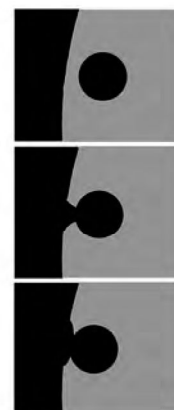


Fig. 5 An elaborate mechanical slide designed to illustrate the Transit of Venus. Maker unknown.

13. W. Newton, *A Familiar Introduction to the Science of Astronomy, Illustrated by Numerous Diagrams* (London: 1844).

14. Edwin Dunkin, *The Midnight Sky* (London: 1869).

15. James Nasmyth and Richard Carpenter, *The Moon: Considered as a Planet* (London: 1874).

16. This is a mahogany framed rackwork slide labelled 'Shooting Star' in the collection of the Museum of the History of Science, Oxford.

17. T.E.R. Phillips, *Hutchinson's Splendour of the Heavens* (London: Hutchinson, 1921). Subsequent editions were published in hard-bound volumes up until the 1940s.

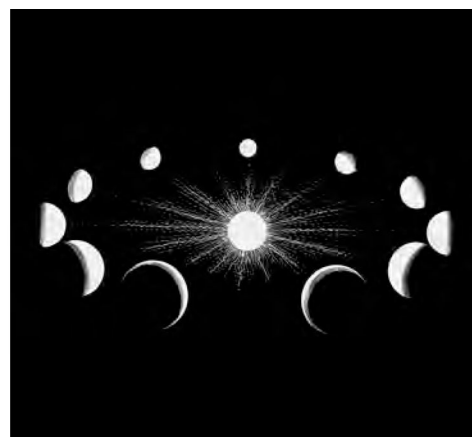


Fig. 6 Carpenter & Westley slides at their finest: The Constellation of Orion, Phases of the Moon and Phases of Venus.

black and white line engravings, but lantern slides gave the opportunity to show the wonderful colours seen in the Universe, and with added animation. The popularity and worldwide use of astronomical slides is remarkable, with slides in almost every conceivable size and format (Fig. 7), although I have not yet seen a set of slides for a toy lantern. There are slides in the archives of most of the major observatories around the world, and in the collections of many museums. Many private collectors also have examples of astronomical rackwork slides, giving some indication of the quantity manufactured over the years.

The invention of photography in 1839 did not immediately influence astronomical slides. For many years, photographic processes were too insensitive to create quality astronomical images. However, in common with all slides the move to the smaller format photographic slides occurred – 3¼ inches (8cm) square in the UK and 3¼ x 4 inches (8 x 10cm) in North America (Fig. 8). Coloured images were either hand-painted or produced using chromolithography. Actual colour photograph slides are virtually unknown: astronomers have never really been interested in colour photography, even with the invention of digital imaging. Rather than take colour images, they expose black-and-white film or sensors through colour filters. This eliminates the major drawbacks of obtaining true colour with very long exposures and ensures accurate colour measurement by using colour filters of precise wavelengths.

During the second half of the nineteenth century, developments in astronomical science began to change our knowledge dramatically, and the subjects shown on slides became more complex and involved. Although manufacturers still made slides showing the common elements, they also began to produce technical teaching sets. By 1900, York & Son were producing a 300-slide set, described as

*by far the most comprehensive set yet published [...] specially adapted to meet the requirements of Public Lecturers and teachers of Science. It embraces the chief results of Modern Astronomical Study and the applications of Spectrum Analysis to the physical constitution of the sun and stars.*¹⁸

By the end of the nineteenth century, producers of astronomical or scientific instruments were also marketing astronomical slides. Many of the world's major observatories began offering slides taken from their most famous photographic images, particularly the Yerkes and Mount Wilson establishments in the USA. In London, the Royal Astronomical Society (RAS) produced slides, and many of its members purchased them for public lecturing and class teaching. By the 1930s even the amateur organisation the British Astronomical Association (BAA) was offering slides and had a rental library for its members. Both the RAS and BAA still have slide collections in their reference libraries.

Lantern and slide manufacturing had begun to decline, and by the 1920s astronomy slides were mainly produced for use in academic institutions or by astronomical societies. Later slide sets often assume a reasonable level of prior knowledge from the audience. Ultimately, the production of slides declined to one or two companies. Newton & Co. produced the last commercial astronomy slides in the UK in the 1930s or early 1940s, before their ultimate demise after the Second World War. Universities and observatories produced their own slides for teaching and lecturing purposes through the 1950s – many made by photographing book illustrations. I recall sitting through astronomy lectures at St Andrews University in the early 1970s, illustrated with appalling black-and-white slides (long before I developed my interest in the lantern). The Keystone View Company was still producing elementary teaching sets of slides into the 1950s and possibly the early 1960s. Even NASA produced slides in the early 1970s as part of their publicity material, including coverage of the early Space Shuttle project.¹⁹

Astronomical slides probably enjoyed a longer commercial existence than any other slide subject. From the earliest associations, through Mary Dicas and Philip Carpenter and the Victorian heyday, they lasted until the 1970s, long after every other slide subject except advertising had faded or moved into other media. Unfortunately, like most other slide types, their existence and importance is virtually unknown to today's astronomers, and even to historians of the science.



Fig. 7 A unique lantern slide photograph of the moon produced by amateur astronomer F.W. Longbottom of Chester, England, on 23 March 1896. Inclusion of details of the telescope and exposure makes this a serious scientific observation.

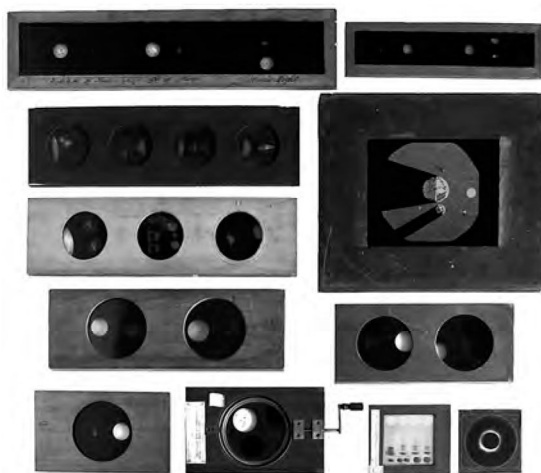


Fig. 8 A wide variety of slide formats and sizes were produced: these examples all illustrate solar eclipses.

Mark BUTTERWORTH has had a lifelong interest in astronomy and is a Fellow of The Royal Astronomical Society. Formerly a business executive, he now divides his time between Scotland and Australia. He specialises in Astronomy, Scottish and Australian lantern slides and frequently presents lantern lectures to Astronomical Societies and International Conventions.

18. York & Son Lantern Slide catalogue, c.1900.

19. See Mark Butterworth, 'The last magic lantern slides?' *Magic Lantern Society Newsletter* 87 (April 2007), 1.